TRANSMITTAL OF APPEAL BRIEF (Large Entity)

Docket No. 1780A1

In Re Application Of: Stuart D. Hellring et al

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/627,775	July 28, 2003	G. B. M. Nguyen	24959	3723	5341

Invention: **PROCESS FOR REDUCING DISHING AND EROSION DURING CHEMICAL MECHANICAL PLANARIZATION**

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Signature

Dated: **March 3, 2006**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	:	PATENT APPLICATION
STUART D. HELLRING ET AL	:	Group Art Unit: 3723
Serial No.: 10/627,775	:	Attorney Docket No.: 1780A1
Filed: JULY 28, 2003	:	Confirmation No. 5341
For: PROCESS FOR REDUCING DISHING AND EROSION DURING CHEMICAL MECHANICAL PLANARIZATION	:	Examiner: G. B. M. NGUYEN

APPEAL BRIEF

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

March 3, 2006

Sir:

Appellants hereby appeal the rejection of the captioned case set forth in the Office Action dated September 9, 2005; the pending claims have been rejected at least twice.

REAL PARTY IN INTEREST

The application has been assigned to PPG Industries Ohio, Inc., Cleveland, Ohio.

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RELATED APPEALS AND INTERFERENCES

No other related appeals or interferences relating to this patent case have been filed.

STATUS OF CLAIMS

Claims 1-29 are pending. Claims 21-23 are withdrawn. Claims 1-20 and 24-29 are rejected and appealed.

STATUS OF AMENDMENTS

A Final Rejection was mailed on September 9, 2005. No Amendment after Final Rejection was filed in this case.

SUMMARY OF CLAIMED SUBJECT MATTER

The present invention is directed to a slurry system which includes the use of at least two slurries (page 3, lines 5-10, of the specification). The first slurry contains an abrasive and is used to partially remove metal from a substrate such as a microelectronic device, for example, a semiconductor wafer. The second slurry having a lower concentration of abrasive than that of the first slurry, or no abrasive, is used to remove the residual metal that remains on the substrate following completion of the first polish with the first slurry. (See page 3, lines 11-18). The metal to be removed typically includes copper, tantalum, silicon dioxide, or mixtures thereof. In an embodiment, the metal is copper. (See page 3, lines 21-23). The abrasive to be used in the slurries can include metal oxides such as alumina, titania, zirconia, gennania, silica, ceria and mixtures thereof. In an embodiment, the abrasive is silica. (See page 3, lines 28-31) The slurries can include other components such as oxidizing, complexing agents, polyvalent cation sequestrants, corrosion inhibitors, thickeners, stopping compounds, static etch controllers, accelerators, metal halides, surfactants, stabilizers and metal chelating agents (page 5, lines 7-8 and page 6, lines 28-31). In both the first polishing step with the first slurry and the second polishing step with the second slurry, the slurries can be applied directly to the substrate, to a polishing pad or to both (page 14, lines 10-11).

GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter.
2. Claims 1-6, 10, 12, 13, 17-20 and 24-29 are rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent 5,985,748.
3. Claims 7, 9, 11 and 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over United States Patent 5,985,748.

ARGUMENT

Objection Specification for Lack of Proper Antecedent Basis

It is alleged that the specification fails to provide proper antecedent basis for the recitation in claim 1 of "wherein said barrier is not completely removed by said slurry system". This objection is respectfully traversed. The specification discloses that microelectronic devices such as semiconductor wafers are fabricated with copper interconnects. The copper interconnects are formed by a multi-step damascene process which includes etching trenches into a dielectric material such as silicon dioxide, inlaying a barrier film such as tantalum into the trenches, filling the trenches with copper, and then applying a thick copper overburden on top of the filled trenches. As a result, there are low areas in the overburden corresponding to the filled-in trenches underneath and high areas corresponding to the space in-between the trenches (referred to as step-height topography). See page 1, lines 9-20, of the specification. In order to place another interconnect level on the substrate (i.e., microelectronic device), removal of the copper overburden layer is required. The claimed invention is directed to a system for removing the step-height topography of the copper overburden (see page 3, lines 1-4). As disclosed in the specification, the "overburden" does not include the barrier film nor does it include the dielectric material. Thus, upon completion of the polishing steps in the claimed invention, the barrier layer and the dielectric layer are remaining. Further, on page 13, lines 5-7, it is disclosed that the second slurry is used to remove the residual copper (not the tantalum barrier layer). Appellants submit that proper antecedent basis is found in the specification and therefore, this objection should not stand.

Rejection of Claims 1-6, 10, 12, 13, 17-20 and 24-29 under 35 U.S.C. 102(b) As Being Anticipated by United States Patent 5,985,748 (Watts)

It is alleged that the Watts reference discloses the two slurry polishing system of the claimed invention. This is respectfully traversed. The Watts reference is directed to a two-step CMP process. In an embodiment, the metal is copper. When copper is used, a conformal tantalum nitride (TaN) film is first applied in order to improve adhesion of the copper and to provide a barrier to prevent unwanted diffusion of the copper into the dielectric material (see column 3, lines 3-10). In the Watts reference, "...a first portion of the metal is removed by the first polishing step... and a second portion, overlying the dielectric layer, is removed by the second polishing step ...." (see column 4, lines 2-8). "...The second step is carried out to remove completely thin metal layer 39a ..." (see column 4, lines 18-19). "...The thin metal layer [39a] includes a portion of the original copper metal and the TaN barrier layer noted above..." (see column 3, lines 56-60). See also Figure 3 that shows the thin metal layer 39a overlaying the dielectric layer 34; and Figure 4 that shows the thin metal layer 39a (which also includes the TaN barrier layer) completely removed. In the present invention, it is disclosed that trenches are etched into a dielectric material, a barrier film is inlaid into the trenches, the trenches are filled with copper, and a thick copper overburden is then placed on top of the filled trenches (see page 1, lines 12-20 of the specification). The overburden results in step-height topography meaning that there are low areas corresponding to the filled-in trenches underneath and high areas corresponding to the space in-between the trenches. The two slurry system of the present invention is directed to removal of the overburden. The first slurry clears less than the entire overburden and the second step clears the remaining overburden (see page 3, lines 1-4). Thus, following completion of the second step of the claimed invention, the barrier layer is remaining.

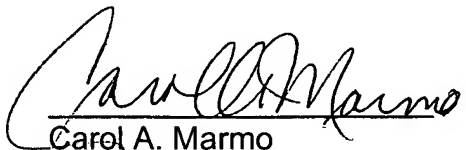
Appellants submit that the present invention is distinguishable from the Watts reference and therefore this rejection should not stand.

Rejection of Claims 7, 9, 11 and 14-16 under 35 U.S.C. 103(a)
As Being Unpatentable Over United States Patent 5,985,748 (Watts)

It is alleged that the Watts reference discloses the claimed invention but does not disclose picolinic acid, precipitated silica, bromic acid, and anticorrosion agent; and it is further alleged that it would have been obvious to utilize such materials. This is respectfully traversed. The Watts reference does not disclose a two slurry system for removal of overburden (e.g., copper) without removal of a barrier layer from a microelectronic device and thus, the present invention would not have been obvious by one of ordinary skill in the art at the time of the invention. In conclusion, Appellants submit that this rejection should not stand.

For all of the above reasons, it is respectfully requested that the case be remanded to the Examiner for issuance of a Notice of Allowance.

Respectfully submitted,



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CLAIMS APPENDIX

1. A slurry system for removal of metal from a substrate, said substrate comprising a dielectric layer, said dielectric layer at least partially connected to a barrier layer and said barrier layer at least partially connected to said metal, said slurry system comprising:

    (a) a first slurry which comprises abrasive and provides for partial removal of said metal from said substrate; and

    (b) a second slurry which provides for further removal of said metal from said substrate,

    wherein said second slurry can be chosen from abrasive-containing slurries or abrasive-free slurries, and wherein said second slurry has a lower concentration of abrasive than said first slurry, and wherein said barrier layer is not completely removed by said slurry system.

2. The slurry system of claim 1 wherein said metal is selected from copper, tantalum, silicon dioxide, or mixtures thereof.

3. The slurry system of claim 1 wherein said metal is copper.

4. The slurry system of claim 1 wherein said second slurry is abrasive free.

5. The slurry system of claim 1 wherein said abrasive is selected from alumina, titania, zirconia, gennania, silica, ceria, or mixtures thereof.

6. The slurry system of claim 3 wherein said abrasive is silica.

7. The slurry system of claim 4 wherein said abrasive is precipitated silica.

8. The slurry system of claim 1 wherein said abrasive is present in an amount of from 0.1 to 30 percent by weight of said first slurry.

9. The slurry system of claim 4 wherein said silica has an aggregate of primary particles, said primary particles having an average diameter of at least seven (7) nanometers, wherein said aggregate has an aggregate size of less than one (1) micron, and a hydroxyl content of at least seven (7) hydroxyl groups per nanometer squared.

10. The slurry system of claim 1 wherein at least one of said first and second slurries further comprise an oxidant.

11. The slurry system of claim 8 wherein said oxidant is selected from inorganic and organic per-compounds, bromic acid, chloric acid, nitrates, sulfates, or mixtures thereof.
12. The slurry system of claim 8 wherein said oxidant is selected from hydrogen peroxide, urea-hydrogen peroxide, or mixtures thereof.
13. The slurry system of claim 1 wherein at least one of said first and second slurries further comprise a material selected from complexing agent, anticorrosion agent, stopping compound, polyvalent cation sequestrant, thickener, or mixtures thereof.
14. The slurry system of claim 1 wherein at least one of said first and second slurries further comprises an acid selected from picolinic acid, dipicolinic acid, qunolinic acid, and mixtures thereof.
15. The slurry system of claim 1 wherein at least one of said first and second slurries further comprises a polyvalent cation sequestrant and a anticorrosion agent.
16. The slurry system of claim 1 wherein at least one of said first and second slurries further comprises a polyvalent cation sequestrant, a anticorrosion agent, and a thickener.
17. The slurry system of claim 1 wherein said first slurry leaves residual metal on said substrate.
18. The slurry system of claim 3 wherein said first slurry leaves residual copper on said substrate.
19. The slurry system of claim 17 wherein said second slurry at least partially removes said residual copper from said substrate.
20. The slurry system of claim 18 wherein said second slurry at least partially removes said residual copper from said substrate.
21. (Withdrawn) A method for removal of copper comprising:
(a) applying to a substrate a first slurry which comprises an abrasive;
(b) applying to said substrate a second slurry,
wherein said first slurry has higher concentration of said abrasive than said second slurry.

22. (Withdrawn) The method of claim 21 wherein said first slurry removes a portion of said copper from said substrate, and leaves residual copper on said substrate.

23. (Withdrawn) The method of claim 21 wherein said second slurry at least partially removes said residual copper from said substrate.

24. A method for polishing a microelectronic substrate comprising:
(a) performing a first polish with a first slurry and polishing pad, wherein said first slurry comprises abrasive; and
(b) performing a second polish with a second slurry and polishing pad wherein said first slurry has higher concentration of said abrasive than said second slurry.

25. The method of claim 24 wherein said first polish provides for partial removal of metal from said substrate and leaves residual portions of said metal on said substrate.

26. The method of claim 25 wherein said second polish provides for at least partial removal of said residual portions of said metal from said substrate.

27. The method of claim 25 wherein said metal is selected from copper, tantalum and silicon dioxide.

28. The method of claim 24 wherein said first polish is completed prior to applying said second slurry.

29. The method of claim 24 further comprising the step of washing said substrate after completion of said first polish and prior to initiation of said second polish.

EVIDENCE APPENDIX

None

RELATED PROCEEDINGS APPENDIX

None